

Signals & Systems: Clever Connections

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Abstract— The ISSC2020 has taken the direction of focusing on the evolving nature of signals connecting Humans, Signals, Systems and the ever increasing role of the internet in connecting peripheral devices. The conference theme aims to reflect these advancements by focusing on interconnectivity between all components, including everything from people to machines. Amelioration of AI and SMART technologies and the emergence of disruptive technologies make 2020 an exciting time to be involved in research. This is reflected greatly in the plenary talks discussed here. Indeed it is the increased depth of consideration of how and when we use data that has provided enhanced systems that reconnect our world.

Keywords— Artificial Intelligence, Autonomous Intelligent Vehicles, Signals and Systems, Industry 4.0.

I. INTRODUCTION

When considering artificial intelligence in the connected world we must consider how our systems use data and signals are used to transmit information between systems. Signals may be used to indicate the state of a system or its environment. In an automobile this information can then be used to inform the underlying systems how to transform or change functionality based on the information received. Information on the location, speed and accuracy of a driver may be passed on to an insurance company but is it ethical to do so? What information should be shared and what protections must be put in place to ensure that we obtain the greatest abilities whilst protecting civil liberties. However, if we take the decision making out of the hands of a human and into the hands of a artificial intelligence, do we risk losing our say? Are artificial intelligence based systems becoming more sentient? These topics and many more were discussed by the plenary speakers.

I. EMBEDDED AI: EXPLOITING BRAIN-LIKE CAPABILITIES TO BUILD SELF-X EMBEDDED SYSTEMS

A. Speaker Bio: Rob Kitchin

Our first plenary speaker was Prof. Rob Kitchen a professor in the Maynooth University Social Sciences Institute, Ireland. He has conducted extensive research on digital technologies and their impact on society, mostly recently through the Programmable City project (funded by ERC) and Building City Dashboards project (funded by SFI). He is (co)author or (co)editor of 30 academic books including: Mapping Cyberspace (Routledge, 2000), Code/Space: Software and Everyday Life (MIT Press, 2011), The Data Revolution (Sage, 2014), Understanding Spatial Media (Sage, 2017), Digital Geographies (Sage, 2018), The Right to the Smart City (Emerald, 2019), and How to Run a City Like Amazon, and Other Fables (Meatspace Press, 2019). He has been an editor of three leading geography journals and editor-in-chief of the 12-volume International Encyclopedia of Human

Geography (Elsevier, 2009). He is a recipient of the Royal Irish Academy's Gold Medal for the Social Sciences

B. Plenary Talk Summary

In this talk Rob Kitchin discussed two inter-related components. The first part considered the ethics of smart city technologies in general, the second part the civil liberties issues raised by the use of technological solutions in tackling the Covid-19 pandemic. The talk detailed the range of technologies being deployed, the various issues they potentially create (e.g., privacy, profiling, social sorting, control creep, citizenship, justice), compares instrumental and normative approaches to framing their ethical use, and argues that we need to actively find ways to ensure that we maximize the benefits of networked technologies while protecting civil liberties and minimizing their pernicious effects.



Fig. 1. Plenary Speaker: Rob Kitchin

II. THE MISSING LINK: HUMAN OR AI

A. Speaker Bio: Ruth G. Lennon

Our next plenary speaker was Ruth G. Lennon an educator and evangelist for DevOps. She has been lecturer with Letterkenny Institute of Technology for 20 years but spends much of her time working with industry in conferences or on research. She currently focuses on cloud computing through Software as a Service particularly the development of Web Services for large-scale secure software development. Ruth actively works on course development to meet both the long and short term needs of industry. Ruth is a member of the ACM, IEEE and is member of the IEEE P2675 DevOps Standard Working Group as well as the ISO/IEC JTC 1/SC 38 Working Group. Ruth is the Chair of the ACM-W Europe.

B. Plenary Talk Summary

In her talk ‘The Missing Link: Human or AI’ focused on the need to evaluate the role of each. Artificial intelligence is certainly the topic of conversation in many conferences but the fear is that AI will become sentient. This begs the question as to what sentient AI is? From the comical representations on TV via Start Trek [1] to the more considered discussions in The Simulation Theory of Consciousness: or Your Autonomous Car is Sentient [2], there is an agreement that ‘acting by choice’ is a significant factor.

As humans we are not good at repeatable tasks. We bore easily and often try to optimise despite the fact that it is not always necessary. The use of tools such as algorithms or systems based on AI is therefore preferable. This is of course dependent on a number of considerations such as cost, energy expenditure and opportunity or lost opportunity. Choosing the right tool, human intervention or the use of AI is certainly important.



Fig. 2. Plenary Speaker: Ruth G. Lennon

Each option has its merits. At present AI cannot replicate a human brain. AI can process information significantly faster than humans [3] however creativity, empathy and critical thinking could arguably be considered the domain of the human mind. The creativity of AlphaGo’s move 37 [4] will remain arguable but it does show a move in the right direction. It is also worth noting that humans and indeed the human brain are still evolving.

Returning to the original question whether the link in decisions in systems should be made by humans or AI, it was noted that AI should assist people in a human-aware way. In speaking with Gunay Kazimzade, TEDx Speaker, this key point was felt essential moving forward. Referred to as Human in the Loop, oversight by humans is shown as necessary as born out by the case of the Viking Sky cruise ship disaster. As a temporary solution moving forward an increased use of AI with monitoring or oversight by Humans seems to offer the best of both worlds.

DevOps is a current example of where this form of automated system can be employed with approval or

monitoring at a high level coming from human stakeholders. In this practical example we remember that AI and Humans all play a role in the future of signals and systems. AI simply becomes a tool to aid us in our focus on creativity and abstract reasoning.

III. EMBEDDED AI: EXPLOITING BRAIN-LIKE CAPABILITIES TO BUILD SELF-X EMBEDDED SYSTEMS

A. Speaker Bio: Jim Harkin

Our next plenary speaker was Dr. Jim Harkin, Reader in Intelligent Embedded Systems, is currently Head of the School of Computing, Engineering and Intelligent Systems at Ulster University. He is an Ulster University Distinguished Learning Support Fellow (2006) and Fellow of the Higher Education Academy UK (2011). He has published over 110 research papers in areas such as fault tolerant embedded systems, neural network hardware and models, networks-on-chip interconnect, and remotely accessible embedded systems. His research investigates the design of highly efficient, secure and reliable embedded systems that emulate the computational and fault tolerance capabilities found in biology.

In particular, he focuses his efforts on addressing electronic reliability challenges by investigating paradigms of Networks-on-Chip interconnect and harnessing the principles of effective repair that is exhibited in the human brain. His research has been supported by the Research Council UK (EPSRC), Innovate UK, US-Ireland R&D, Human Frontiers Science Program, and InvestNI. He is Associate Editor for IET Computers and Digital Techniques and Review Editor for Neuromorphic Engineering in Frontiers in Neuroscience. He is a member of the IET and IEEE, and also IEEE Circuits and Systems Society (CASS) Technical Committee member of both Neural Systems and Applications and Sensory Systems. He is also CTO of Smartair Medical, a start-up company focused on building AI-based healthcare technology for asthma management.



Fig. 3. Plenary Speaker: Dr Jim Harkin

B. Plenary Talk Summary

Software has been a part of automobiles since 1976 [5]. The addition of software to automobiles increases the functionality but also increases the complexity. The need for vehicles to self manage, self-organize and self heal is integral to the evolution of vehicles. This ability is often referred to as Self-X. In his talk, Jim Harkin spoke of exploiting brain like capabilities to build self-x embedded systems. Adapting behavior to the surrounding environment is difficult and involves many competing requirements. Continuous monitoring to define the environment or state of the device is often referred to as self-awareness.

IV. CONCLUSION

The three plenary speakers spoke to different aspects of connected systems. Each speaker noting the interplay needed between systems to achieve the greater good. This clever interplay of system elements, often enhanced by human oversight is supported by a myriad of signals utilised to progress systems to the next stage of a process. In this conference the theme of signals, systems and the interconnection of IoT devices was spoken of not only by the plenary speakers but by many of the presenters throughout the conference.

References

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